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09/817,696	03/23/2001	Howard R. Test	TI-30589	9347

7590

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EXAMINER

RICHARDS, N DREW

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 12/30/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/817,696

Applicant(s)

TEST ET AL.

Examiner

N. Drew Richards

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 03 October 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 7-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 7-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Objections*

1. Claims 18 and 19 are objected to because of the following informalities: Claim 18 recites "plating a barrier layer" where it should recite "plating **said** barrier layer." Claim 19 recites "plating a bondable layer: where it should read "plating **said** bondable layer." Appropriate correction is required.

### *Claim Rejections - 35 USC § 112*

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:  
  
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
3. Claim 23 recites the limitations "said step of plating" in line 1, and the limitation "said barrier" in line 1. There is insufficient antecedent basis for these limitations in the claim.
4. Claim 24 recites the limitation "said step of plating" in line 1. There is insufficient antecedent basis for this limitation in the claim.
5. Claim 25 recites the limitations "said step of plating" in line 1, and the limitation "said barrier" in line 1. There is insufficient antecedent basis for these limitations in the claim.
6. Claim 19 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 19 recites the bondable layer having a thickness in the range of 0.4 to about 1.5 micrometers. Claim 16, from which claim 19 depends, recites the bondable layer having a thickness of at least 1.5 micrometers. It is indefinite as to

what thickness is being claimed. It is indefinite as to how claim 19 further limits claim 16 as the range of claim 19 does not fall within the range of claim 16.

7. Claims 23-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 23-25 recite limitations dealing with a "barrier layer" and a "bondable layer." These layers are not in independent claim 22 from which claims 23-25 depend. It is indefinite as to whether claims 23-25 are further limiting the layers and steps claimed in claim 22 or whether they are introducing new steps for forming further layers. It seems that claims 23-25 should recite "a layer of nickel" instead of the barrier layer and "a layer of gold" instead of the bondable layer.

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 7-10 and 13-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Molla et al. (U.S. Patent No. 6,362,089 B1) in view of Ahmad et al. (U.S. Patent No. 5,436,412).

Molla et al. teach a method of forming metallurgical connections between metal wires and bond pads positioned on integrated circuits having copper interconnecting metallization on columns 1-6 and in figures 1-5. Specifically, Molla et al. teach

activating the surface of the copper metallization of the bond pads, depositing seed metal (col. 2 line 49 through col. 3 line 24). Molla et al. then teach plating a layer of barrier metal by electroless deposition that resists copper diffusion (col. 3 lines 25-35). Molla et al. then teach plating a layer of a bondable metal that reduces the diffusion of the barrier metal, thereby forming the outermost bondable metal layer of the bond pad (col. 3 lines 36-44). Molla et al. does not explicitly teach the bondable metal being deposited by electroless deposition, however, Molla et al. states that the layer can be formed by techniques that are well known in the art. Molla et al. teach in the background section (col. 1 lines 22-30) depositing layers on copper by electroless deposition and, for the case of gold, immersion electroless deposition. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to deposit the outermost bondable layer (gold) by the electroless deposition used in the background in the process of Molla et al. Molla et al. then teach bonding metal wires onto the outermost metal (col. 4 lines 13-16).

With regard to the thickness of the barrier metal reducing diffusion of the layer below by 80% compared to the diffusion in the absence of the layers, the thickness taught by Molla et al. for the barrier layer is considered to read on this limitation.

Molla et al. do not teach the bondable layer having a thickness sufficient to reduce diffusion of the barrier layer by 80%. Ahmed et al. teach a copper metallization including forming nickel and gold on copper. Ahmed et al. teach the gold being a few microns thick (col. 4 line 51). Ahmed et al. teach their metallization to provide a strengthened structure that is resistant to corrosion and provides a thicker, harder gold

layer. It would have been obvious to one of ordinary skill in the art at the time of the invention to form the thicker, harder gold layer of Ahmed et al. (a few microns thick). The motivation for doing so is to provide a harder layer that is resistant to corrosion. Thus, it would have been obvious to combine Molla et al. with Ahmed et al. to obtain the invention of claim 7.

With regard to claim 8, Molla et al. teach solder ball bonding and wire bonding, therefore Molla et al. is considered to teach the wire bonding step comprising ball bonding.

With regard to claim 9, Molla et al. do not teach depositing a protective overcoat over the integrated circuit including the copper and exposing the copper through the overcoat by photolithographic techniques. Ahmad et al. teach a method of forming copper metallization in integrated circuits. Ahmad et al. teach in figure 5E depositing a protective overcoat 50 and opening selected areas of the overcoat exposing the surface of the copper metallization.

Molla et al. and Ahmad et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form a protective overcoat and etch portions away to expose the copper. The motivation for doing so is provide a passivation layer over the substrate and to insulate the copper and bonded wire from adjacent conductors. Therefore, it would have been obvious to combine Molla et al. with Ahmad et al. to obtain the invention of claim 9.

With regard to claim 10, Molla et al. teach cleaning before activating the copper surface. In combination with Ahmad et al., the cleaning step would be performed after the etching step to remove contaminants and cupric oxide. Molla et al. teach cleaning by immersing the exposed copper in a solution of sulfuric acid.

With regard to claim 13, the electroless plating of the bondable layer is immersion plating (col. 1 line 22-30).

With regard to claim 14, Molla et al. does not teach immersion plating followed by autocatalytic plating, however, this step is considered obvious as autocatalytic plating is a well known process in the art for depositing gold and Molla et al. has recognized that the gold can be formed by techniques well known to those skilled in the art. Thus, it would have been obvious to form the layer by immersion plating followed by autocatalytic plating.

With regard to claim 15, the limitation of electrically probing leaving no probe marks is not limiting to the process of forming the device. This step does not change the device structure in any way during the process. Further, the device of Molla et al. is capable of performing the probing step without leaving any marks as the outermost bondable layer of Molla et al. is the same as in the present invention and thus would have the same hardness to resist probe marks.

With regard to claim 16, Molla et al. teach activating the surface of the copper metallization of the bond pads, depositing seed metal (col. 2 line 49 through col. 3 line 24). Molla et al. then teach plating a layer of barrier metal by electroless deposition that has a thickness of at least .5 micrometers and is selected from the group consisting of

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nickel, cobalt, chromium, molybdenum, titanium, tungsten, and alloys thereof (col. 3 lines 25-35). Molla et al. then teach plating a layer of a bondable metal selected from the group consisting of gold, palladium, platinum, and silver (col. 3 lines 36-44). Molla et al. does not explicitly teach the bondable metal being deposited by electroless deposition, however, Molla et al. states that the layer can be formed by techniques that are well known in the art. Molla et al. teach in the background section (col. 1 lines 22-30) depositing layers on copper by electroless deposition and, for the case of gold, immersion electroless deposition. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to deposit the outermost bondable layer (gold) by the electroless deposition used in the background in the process of Molla et al. Molla et al. then teach bonding metal wires onto the outermost metal (col. 4 lines 13-16).

Molla et al. do not teach the bondable layer having a thickness of at least 1.5 micrometers. Ahmed et al. teach a copper metallization including forming nickel and gold on copper. Ahmed et al. teach the gold being a few microns thick (col. 4 line 51). Ahmed et al. teach their metallization to provide a strengthened structure that is resistant to corrosion and provides a thicker, harder gold layer. It would have been obvious to one of ordinary skill in the art at the time of the invention to form the thicker, harder gold layer of Ahmed et al. (a few microns thick). The motivation for doing so is to provide a harder layer that is resistant to corrosion. Thus, it would have been obvious to combine Molla et al. with Ahmed et al. to obtain the invention of claim 16.



With regard to claim 17, Molla et al. do not explicitly disclose conducting a self-limiting surface metal replacement and an autocatalytic deposition. However, Molla et al. has recognized that the gold can be formed by techniques well known to those skilled in the art. Self-limiting surface metal replacement and autocatalytic deposition processes are considered well known in the art and are thus considered taught by Molla et al.

With regard to claim 18, the barrier layer of Molla et al. has a thickness in the range of about .5 to about 1.5 micrometers.

With regard to claim 19, the bondable layer of Molla et al. with Ahmad et al. has a thickness in the range of about .4 to 1.5 micrometers.

With regard to claim 20, Molla et al. do not teach depositing a protective overcoat over the surface of the integrated circuit including the surface having copper and metallization opening selected areas of the overcoat exposing the surface of the copper metallization. Ahmad et al. teach in figure 5E depositing a protective overcoat 50 and opening selected areas of the overcoat exposing the surface of the copper metallization.

Molla et al. and Ahmad et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form a protective overcoat and etch portions away to expose the copper. The motivation for doing so is provide a passivation layer over the substrate and to insulate the copper and bonded wire from adjacent conductors. Therefore, it would have been obvious to combine Molla et al. with Ahmad et al. to obtain the invention of claim 20.

With regard to claim 21, Molla et al. teach immersing the exposed surface of the copper metallization in an acid solution.

With regard to claim 22, Molla et al. teach depositing palladium seed metal (col. 2 lines 49 through col. 3 line 24) to activate the surface of the copper of the bond pads. Molla et al. then teach plating a layer of nickel by electroless deposition that has a thickness of at least .5 micrometers (col. 3 lines 25-35). Molla et al. then teach plating a layer of gold (col. 3 lines 36-44). Molla et al. does not explicitly teach the gold being deposited by electroless deposition, however, Molla et al. states that the layer can be formed by techniques that are well known in the art. Molla et al. teach in the background section (col. 1 lines 22-30) depositing layers on copper by electroless deposition and, for the case of gold, immersion electroless deposition. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to deposit the gold by the electroless deposition used in the background in the process of Molla et al. Molla et al. then teach bonding metal wires onto the outermost metal (col. 4 lines 13-16).

Molla et al. do not teach the gold having a thickness of at least 1.5 micrometers. Ahmed et al. teach a copper metallization including forming nickel and gold on copper. Ahmed et al. teach the gold being a few microns thick (col. 4 line 51). Ahmed et al. teach their metallization to provide a strengthened structure that is resistant to corrosion and provides a thicker, harder gold layer. It would have been obvious to one of ordinary skill in the art at the time of the invention to form the thicker, harder gold layer of Ahmed et al. (a few microns thick). The motivation for doing so is to provide a harder layer that

is resistant to corrosion. Thus, it would have been obvious to combine Molla et al. with Ahmed et al. to obtain the invention of claim 22.

With regard to claim 23, Molla et al. do not explicitly disclose conducting a self-limiting surface metal replacement and an autocatalytic deposition. However, Molla et al. has recognized that the gold can be formed by techniques well known to those skilled in the art. Self-limiting surface metal replacement and autocatalytic deposition processes are considered well known in the art and are thus considered taught by Molla et al.

With regard to claim 24, the barrier layer of Molla et al. has a thickness in the range of about .5 to about 1.5 micrometers.

With regard to claim 25, the bondable layer of Molla et al. with Ahmad et al. has a thickness in the range of about .4 to 1.5 micrometers.

With regard to claim 26, Molla et al. do not teach depositing a protective overcoat over the surface of the integrated circuit including the surface having copper and metallization opening selected areas of the overcoat exposing the surface of the copper metallization. Ahmad et al. teach in figure 5E depositing a protective overcoat 50 and opening selected areas of the overcoat exposing the surface of the copper metallization.

Molla et al. and Ahmad et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form a protective overcoat and etch portions away to expose the copper. The motivation for doing so is provide a passivation layer over the substrate and to insulate the copper and bonded wire from adjacent conductors.

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Therefore, it would have been obvious to combine Molla et al. with Ahmad et al. to obtain the invention of claim 26.

10. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Molla et al. with Ahmad et al. as applied to claims 7-10 and 13-26 above, and further in view of Lopatin et al. (U.S. Patent No. 6320263 B1).

With regards to claims 11 and 12, Molla et al. with Ahmad et al. teach activating the copper surface by immersing the bond pads in a metal solution but do not teach the solution is a metal chloride or specifically palladium chloride. Lopatin et al. teach activating the copper surface and teach activating by immersion in a palladium chloride solution.

Molla et al. with Ahmad et al. and Lopatin et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to activate the copper by immersing in a palladium chloride solution. The motivation for doing so is to prepare the surface for further metal deposition. Therefore, it would have been obvious to combine Molla et al. and Ahmad et al. with Lopatin et al. to obtain the invention of claims 11 and 12.

### ***Double Patenting***

11. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

12. Claims 7-26 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 16-25 of copending Application No. 09/775322. Although the conflicting claims are not identical, they are not patentably distinct from each other because the same process is claimed in both applications even though the barrier layer and bondable layer have been claimed by different physical properties.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

#### ***Response to Arguments***

13. Applicant's arguments with respect to claims 7-15 have been considered but are moot in view of the new ground(s) of rejection.

#### ***Conclusion***

14. Applicant's submission of an information disclosure statement under 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p) on 10/8/02 prompted the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 609(B)(2)(i). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

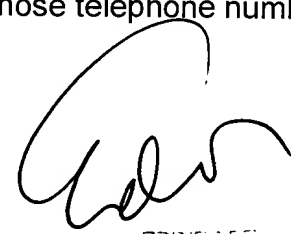
Any inquiry concerning this communication or earlier communications from the examiner should be directed to N. Drew Richards whose telephone number is (703) 306-5946. The examiner can normally be reached on M-F 8:00-5:30; Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

  
NDR

December 29, 2002

  
SUPERVISOR  
TECHNICAL CENTER